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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/556,777	04/25/2000	Akira Goda	0039-7692-2S	8088

7590 11/04/2002

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EXAMINER
SOWARD, IDA M

ART UNIT	PAPER NUMBER
2822	

DATE MAILED: 11/04/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/556,777	GODA ET AL.
	Examiner	Art Unit
	Ida M Soward	2822

-- The MAILING DATE of this communication appears on th cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 October 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3 and 5-25* is/are pending in the application.

4a) Of the above claim(s) *6-10 and 15-18* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,5,11-14 and 19-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *12* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

This Office Action is in response to the amendment filed on October 3, 2002.

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-3 and 5 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Iwahashi et al. (4,495,693) in view of Gonzalez (US 2001/0002711 A1).

Iwahashi teaches a nonvolatile semiconductor memory device (abstract) comprising: a semiconductor substrate (Fig. 11L, Ref. # **128**); a first transistor formed in a peripheral circuit portion **166** of the semiconductor substrate, the first transistor including source **142a** and drain **140a** diffusion layers formed in one of the plurality of element regions and a gate electrode **138a** having a first gate length; a second transistor including source **132a** and drain **130a** diffusion layers formed in another

plurality of element regions and a gate electrode **122a** having a second gate length **122** shorter than the first gate length **138a**; a first insulating film **158** formed above at least the memory cell portion, the first insulating film covering the second transistor; an element isolation region **144a** formed in the semiconductor substrate, the element isolation region isolating a plurality of element regions in the semiconductor substrate; a contact connected to one of the source and drain diffusion layers (Figure 15). Also, the limitations of the first insulating layer having a property that makes it difficult for an oxidizing agent to pass therethrough and the gate electrodes being oxidized are inherent in the art of semiconductor devices. One of the purposes of insulating layers is to protect the device from such oxidizing agents as oxygen and ozone. In addition, gate material and other material become oxidized when exposed to the atmosphere. However, Iwahashi et al. fail to teach a first insulating film different from silicon oxide. Gonzalez teach a first insulating film **30** different from silicon oxide (Figure 4, page 3, paragraph [0037]. Gonzalez further teaches a metal **41** formed in an insulating film **30**. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the structure of Iwahashi et al. with the first insulating film of Gonzalez to decrease operating voltages.

Claims 11, 14 and 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iwahashi et al. (4,495,693) and Gonzalez (US 2001/0002711 A1) as applied to claims 1-2, 3 and 5 above, and further in view of Chang et al. (4,769,340) and Yokoi et al. (4,866,003).

Iwahashi et al. and Gonzalez teach all mentioned in the rejection above. Chang et al. teach erasable and programmable memory cell transistors (abstract). Yokoi et al. teach an insulating film **7** used as an etching stopper when contact holes **8 & 9** are formed, a silicon nitride film **12** covering the transistor, and a concentration of hydrogen in the silicon nitride that is smaller than 3×10^{21} atom/cm^3 (col. 3, lines 37-41). However, Iwahashi et al. fail to teach these limitations. Also, it is well known in the semiconductor art for the concentration of an impurity to be higher at the surface and decreases deeper into the material. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the structure of Iwahashi et al. and the first insulating film of Gonzalez with the memory cell transistors of Chang et al. and the insulating film of Yokoi et al. to provide a semiconductor device which is free from the deterioration in device characteristics due to hot carriers by having a reduced amount of hydrogen in the silicon nitride film.

Claims 12-13 and 21-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iwahashi et al. (4,495,693), Gonzalez (US 2001/0002711 A1), Chang et al. (4,769,340) and Yokoi et al. (4,866,003) as applied to claims 1-2, 3 5, 11, 14 and 19 above, and further in view of Saito et al. (4,467,452) and Tseng (5,731,130). Iwahashi et al. Gonzalez, Chang et al. and Yokoi et al. teach all mentioned in the rejection above. However, Iwahashi et al. Gonzalez, Chang et al. and Yokoi et al. fail to teach a silicon nitride film having a thickness of at most 50 nm and an oxide film on the surface of the silicon nitride film having a thickness. Saito et al. teach a silicon nitride

film **66** having a thickness ranging from 40 to 60 nm (col. 6, lines 53-62) in which 50 nm is included. Tseng teaches the oxidation of a silicon nitride film **40** with a preferred total thickness of about 1 to 10 nm (col. 8, lines 42-49). Thus, an oxide film not smaller than 1 nm and not larger than 10 nm could have been formed from the teachings of Tseng. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the structure of Iwahashi et al., the first insulating film of Gonzalez, the memory cell transistors of Chang et al. and the insulating film of Yokoi et al. with the oxidation of the silicon nitride films of Tseng and the silicon nitride thickness of Saito et al. to provide a nonvolatile memory device with an excellent storage retention time.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The following patents are cited to further show the state of the art with respects to insulating films preventing oxidation:

Akram (US 2001/0038137 A1) Bryant (US 2002/0031870 A1)

Iwamatsu et al. (US 2002/0009837 A1) Saitou et al. (US 2002/0003288 A1).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ida M. Soward whose telephone number is (703) 305-

3308. The examiner can normally be reached on Monday through Thursday, from 6:30 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached at (703) 308-4905. The Group fax number is (703) 872-9318.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

ims

10/30/02

AMIR ZARABIAN
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